

Appl. No. 09/324,823
Response to Office Action Mailed October 19, 2005

REMARKS

Applicants respectfully request reconsideration of the prior art rejection set forth by the Examiner under 35 USC §§102 and 103. Applicants respectfully submit that the prior art references of record, whether considered alone or in combination, fail to either teach or suggest Applicants' presently claimed invention. Applicants' claimed invention is directed to an improved solid state image sensor device and method of driving a solid state image sensor device which is capable of operating in both an interlaced mode and a progressive mode wherein all of the signal charges are simultaneously read out from each imaging device independently and without being combined.

More specifically, the present invention is directed to an imaging device employing a photodiode and preferably a Hole Accumulation Diode as specified in dependent claims 4-6. (See page 10 of the instant application). In the conventional HAD sensor, it is necessary to apply a bias voltage V_{sub} to the substrate for normal operations. Accordingly, a substrate bias terminal such as the terminal 2e described in the specification is employed. Conventional HAD sensors did not use adjustment of the bias voltage applied to the substrate terminal as described and claimed in the instant application.

None of the references cited by the Examiner provide the requisite teaching or suggestion to result in the claimed subject matter. More specifically, none of the references describe Applicants' claimed photodiode sensor wherein the substrate bias voltage is adjusted as specified in the claims depending on the type (interlaced or progressive) of read-out operation employed.

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A proper rejection requires that a single reference describe the claimed subject matter or that there be a combination of references that teach or suggest that a feature not present in a single reference would be applicable to the subject matter of a deficient reference. In the present situation, there is no reference or combination of references that indicates the desirability of applying bias adjustment depending on the type of operation (interlaced or progressive readout) for a HAD sensor as claimed in the instant application such that the saturation signal quantity in the progressive scan mode is substantially equivalent to the saturation signal quantity in the interlaced mode.

Suzuki fails to teach such a device. First, Applicants note that the *Suzuki* reference fails to teach or suggest the use of a progressive scan output. Rather, both of the field and frame read-out methods are interlaced read-out methods. As clearly shown in Figure 7(A), during interlaced frame reading, all of the even lines are read out and vertically transferred to the horizontal transfer register 22 where the charges are eventually transferred to the output 23. After this, the odd lines are read out and are then vertically transferred to the horizontal transfer register 22 where the charges are eventually transferred to the output 23.

In the second interlaced read-out method, the field method, all pixels are read out simultaneously, however, vertically adjacent pixels are added together (mixed) as shown in Figure 7(A).

For this reason alone, Applicants submit that the reference fails to teach or suggest the limitation of the claim which requires a progressive scan output, defined in the specification on page 1 to require the simultaneous read-out of all picture element signals without mixing.

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Additionally, Applicants submit that none of the cited prior art references teach or suggest that the desirability of applying bias adjustment depending on the type of operation for a HAD sensor as claimed in the instant application such that the saturation signal quantity in the progressive scan mode is substantially equivalent to the saturation signal quantity in the interlaced mode.

Initially, in order to clear any confusion, Applicants submit that the Examiner has misconstrued the term 'saturation signal quantity.' It is apparent from the last Office Action that the Examiner has construed this language to mean that the V_{sub} signals applied to the substrate are substantially equal during progressive mode and interlaced mode read-out. (See page 5 of the Office Action, in which the Examiner cites to *Suga* '980 and states that "...and the applied bias voltages ... are chosen ... such that a saturation signal (i.e., noted the V_{sat} as shown in Fig. 11C) quantity in the progressive mode ... is substantially equivalent to that in the interlaced mode.")

However, Applicants submit that to the extent the Examiner cites the prior art as teaching the application of substantially equivalent V_{sub} voltages, the prior art then actually teaches away from Applicant's invention. Applicant's invention is directed to applying different V_{sub} voltages to the substrate in order to obtain saturation signal quantities that are substantially equivalent in both an interlaced read-out mode and a progressive read-out mode.

In contrast to the Examiner's construction of the term, Applicant's clearly define the term 'saturation signal quantity' on page 2 of the specification, stating "The saturation signal quantity means a maximum signal quantity when a solid state image sensor device outputs a right signal, in short, it is decided dependent on the quantity of charge which can be

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accumulated in a photodiode in a solid-state image sensor device corresponding to a picture element in an image.” Accordingly, Applicants submit that the claims of the instant invention are directed to a novel method of overcoming the shortcomings and deficiencies of the prior art by applying different substrate bias voltages such that **saturation signal quantities** in both progressive and interlaced mode are **substantially equivalent**.

For this reason also, Applicants submit that the references fail to teach or suggest all of the limitations of the claims.

Accordingly, in light of the foregoing, Applicants respectfully submit that the references of record fail to provide the requisite teaching or suggestion to support the rejection of the claims as set forth by the Examiner. Applicants respectfully request that the Examiner now withdraw these rejections and allow all claims in the application.

Respectfully submitted,

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